

(19) World Intellectual Property  
Organization  
International Bureau



(43) International Publication Date  
15 January 2004 (15.01.2004)

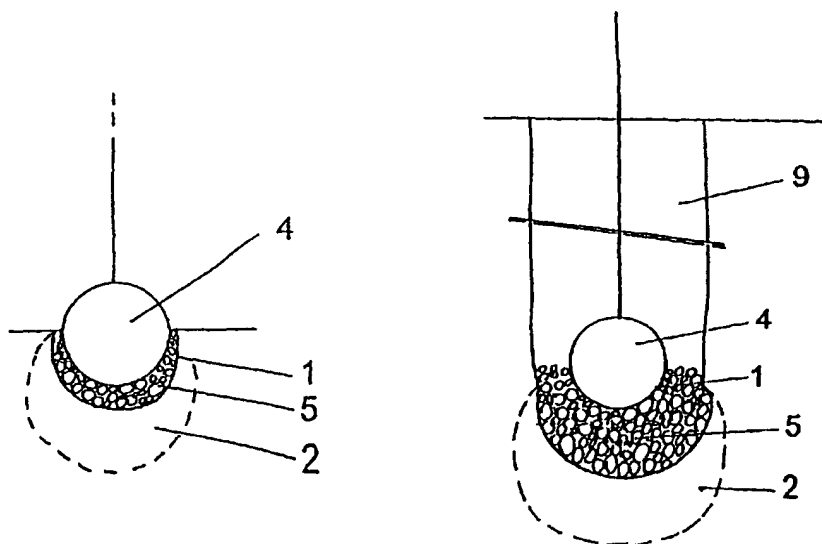
PCT

(10) International Publication Number  
**WO 2004/005626 A1**

- (51) International Patent Classification<sup>7</sup>: **E02D 5/44**, 3/054, 3/08 (74) Agent: VARGA, Tamás, Péter; Bertalan L. u. 20. fsz. 3/A., H-1111 Budapest (HU).
- (21) International Application Number: PCT/HU2002/000156 (81) Designated States (*national*): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SD, SE, SG, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZM, ZW.
- (22) International Filing Date: 20 December 2002 (20.12.2002)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data: P0202208 8 July 2002 (08.07.2002) HU (84) Designated States (*regional*): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).
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- Published:  
— with international search report

[Continued on next page]

(54) Title: METHOD FOR INCREASING LOAD-BEARING CAPACITY OF SOIL



(57) Abstract: The invention relates to a method for increasing value of physical parameters and load-bearing capacity of soil as well as decreasing consolidation time and expectable settlement, during which a hollow is created by ramming or vibropressing in the soil and a grainy additive, preferably coarse gravel is put into the hollow, then this additive is compacted into the soil by ramming, which is characterized by that, during the ramming the additive compacted into the soil breaks down the original structure of soil and the additive is restructured with the local soil, then additional additive is put into the hollow by additional ramming and this process is repeated until the soil is filled with additive, by this an outer compacted local soil-zone and an inner compacted local soil-zone consisting of a mixture of the additive and the local soil are created, and on said soil a plane basement of a building is made.

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*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

## METHOD FOR INCREASING LOAD-BEARING CAPACITY OF SOIL

The invention is a method for increasing value of physical parameters and load-bearing capacity of soil as well as decreasing consolidation time and expectable settlement, making possible plane foundation and building on soft or less set soils.

The first and most important phase of starting on building is ensuring the proper foundation of the buildings. It happens more and more often with the increase of the area of cities, that building becomes necessary on soils of weak physical conditions, soils unsuitable for plane foundation. It often happens, that foundations must be made on boggy, marshy, waterlogged, muddy, sodden areas, in old river-beds, or on place of old waste deposits. It also occurs, that various works, for example railways, roads, power lines, utility lines have to be built on soils with unfavorable conditions. Solution for making foundations and building on such areas was applying various pile-drivers. Earlier it was made by wooden piles, nowadays beside well-spread technologies various concrete piles and pile-driving methods are used, for example „Franki” pile-driving, prefabricated pile-driving, slot-wall building technologies, vibratory pile drivers.

In the state of art Hungarian patent application P 92 03358 dated 28/11/1995, published under number H 3766, makes known renewable pipe or closed profile suitable particularly for making in-site piles. The pipe or closed profile is hollow, respectively blank along its lengthwise axle and there are at least two recyclable closing elements placed in arrow shape, which are preferably clams joining like beaks. In the inside of the pipe there are one or more non-return valves functioning as valves. Furthermore the patent makes known recyclable pipes or closed profiles, which are also hollow, respectively blank along their lengthwise axle and the hollow inside the pipe is shaped funnel-like from the top and narrowing arch-like from the bottom at the end close to the part joining the soil or at a certain distance from the end.

Hungarian patent application number P 92 03359 dated 28/11/1995, published under number H 3766 H 3760, makes known a method for soil-zones of great load-bearing capacity. With this method zones suitable for foundation and building can be created on the surface, respectively under the surface of slack soils or grounds of low load-bearing capacity. Depending on the type of works these zones can be made separated from each other at certain points, or next to each other as stripes, or in case of slabs covering the whole area. When applying the method the local soil which is in given case sodden or waterlogged is compacted with an in-site soil-compacting method and solid grainy or lumpy additive material is added at the time of compacting. The additive is jammed to the soil during compacting and this way a soil-zone consolidated with the local soil is created and this soil-zone is mechanically working together with the local soil. Way of compacting can be stamping and/or vibrolithic and/or tamping and/or exploding. The applied additive

can preferably be sized or ungraded detritus, coarse gravel, rock-waste, pebble stone, concrete refuse or sand or crushed gravel or slag of fine grains, preferably of 3-5 mm diameter.

The solutions already known suffer from a limitation, that stamping does not ensure proper stability in case of certain types of soil, for example moor lands, it does not ensure integral restructuring with the soil, so especially in case of sodden, muddy soils does not ensure the proper working together of the pile and the soil. Pile-driving and slot-wall building are expensive technologies requiring special machinery with high operational costs resulting in end-products of high price-level.

When working out the solution according to the invention we aimed to elaborate a method, which is suitable for increasing value of physical parameters and load-bearing capacity of soil as well as decreasing time of consolidation and expectable settlement and makes possible plane foundation and building on soft or less set soils.

When working out the solution according to the invention we realized, that in case we apply a method, during which a hollow is created by ramming or vibropressing in the soil and a grainy additive, preferably coarse gravel is put into the hollow, then this additive is compacted into the soil by ramming, during the ramming the additive compacted into the soil breaks down the original structure of soil and the additive is restructured with the local soil, then additional additive is put into the hollow by additional ramming and this process is started over until the soil is filled with additive, by this an outer compacted local soil-zone and an inner compacted soil-zone consisting of a mixture of the additive and the local soil are created, then the set aim can be achieved.

The invention relates to a method for increasing value of physical parameters and load-bearing capacity of soil as well as decreasing consolidation time and expectable settlement, during which a hollow is created by ramming or vibropressing in the soil and a grainy additive, preferably coarse gravel is put into the hollow, then this additive is compacted into the soil by ramming, which is characterized by that, during the ramming the additive compacted into the soil breaks down the original structure of soil and the additive is restructured with the local soil, then additional additive is put into the hollow by additional ramming and this process is repeated until the soil is filled with additive, by this an outer compacted local soil-zone and an inner compacted local soil-zone consisting of a mixture of the additive and the local soil are created, and on said soil a plane basement of a building is made.

In a preferred application of the method according to the invention forming of the hollow takes place on the ground surface in the beginning of the method.

In another preferred application of the method according to the invention before forming the hollow a pre-grabbed hollow is formed and ramming and putting in additive take place on the bottom of said pre-grabbed hollow making deeply located soil or soil unsuitable for plane foundation or soil of low load-bearing capacity, for

example moor lands, slobbs, loose replenishments, river-beds suitable for load-bearing.

In a further preferred application of the method according to the invention during ramming and putting in additive the pre-grabbed hollow is filled in as well and in the side of said filled-in pre-grabbed hollow an outer compacted soil-zone is formed, as well as an inside compacted soil-zone consisting of a mixture of the additive and the local soil.

In a further preferred application of the method according to the invention in the first phase of the method forming of the hollow and/or forming of a deep hollow takes preferably place by vibropressing.

In a further preferred application of the method according to the invention additive applied is coarse gravel of grains larger than 60 mm, coarse gravel of maximum 200-250 mm diameter grains, and/or crushed gravel and/or concrete refuse, and/or detritus, and/or pebble stone.

In a further preferred application of the method according to the invention output of ramming is 4-5 tons mass dropped from a height of 6-10 m.

In a further preferred application of the method according to the invention the shape of drop-stamp is ball-shape, or a truncated cone with a flat-end, or a cylinder with a flat-end.

In a further preferred application of the method according to the invention in the upper plane of the soil-zones formed in given distance next to each other, a plane of given thickness compacted and filled in with additive preferably by a drop-stamp of flat-end is formed providing plane foundation for the building together with the load-bearing soil zones.

In a further preferred application of the method according to the invention in the upper part of the compacted soil-zone a spot of hemisphere shape is formed preferably by a ball-shaped drop-stamp and said spot of hemisphere shape is filled in with concrete, then on the upper part of said hemisphere shape spot a reinforced concrete slab is formed providing stabilizing and load-taking. Method according to the invention will be obvious to persons skilled in the art from the foregoing description of examples of application:

**Example 1:**

In a preferred application of the method according to the invention in case of foundation near the surface of soils unsuitable for plane foundation, with depth of 2-4 m below the surface, forming the hollow and the stamping take place near the soil surface at freezing level. When applying the method a hollow is created by ramming or vibropressing in the soil and a grainy additive, preferably coarse gravel is put into the hollow, and the additive is compacted into the soil by ramming. During the